

Supplier firms in transition – the case of Denmark

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Chapter 5: Supplier Firms in Transition – The Case of Denmark

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Abstractⁱ

In this chapter we identify three types of supplier firms based on their value creation activities towards main customers: Detached, Technology-focused and Integrated Suppliers. The supplier types vary in their engagement with their most important customers, but not in performance. The interaction-oriented nature of the Danish Innovation System is also reflected in the identified supplier types, and there are no signs of global competition and production relocation undermining this distinctive feature of the Danish system. The study concludes that the globalization of manufacturing activities is not as great a challenge as might have been expected for Danish suppliers.

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5.1 Introduction

Interfirm relations, including user-producer interactions, play an important role in structuring a National Innovation System (Lundvall 2016). However, increasing internationalization changes the framework for relations between firms. This chapter focuses on how supplier firms in Denmark, like suppliers in other high-cost countries, may face challenges in maintaining their value proposals to local customers as manufacturing activities in these countries decline. Norden (2015) reports that employment in manufacturing declined by approximately 500,000 people in the Nordic countries during the period of 1991 – 2013, and a similar trend is seen in other high-cost Western countries. In the 1990's, suppliers frequently enjoyed being close to their customers' production activities (Andersen 1999). Now, digitalization has improved possibilities for global coordination of value chains and improved conditions for doing business in a wide range of low-cost countries (Holmström and Partanen 2014). Thus, the dominant reason for offshoring from high-cost countries is lower cost (Stehrer et al. 2012). This has contributed to a global shift in the centre of manufacturing from highly industrialised high-cost countries to low-cost countries (Quah 2011). Figures 5.1 and 5.2 clearly illustrate the relocation of activities in the industry sector from Denmark and other high-cost countries to low-cost countries. Supplementary calculations of value added per employee in industry shows that this has increased most rapidly in the East Asia region.ⁱⁱ

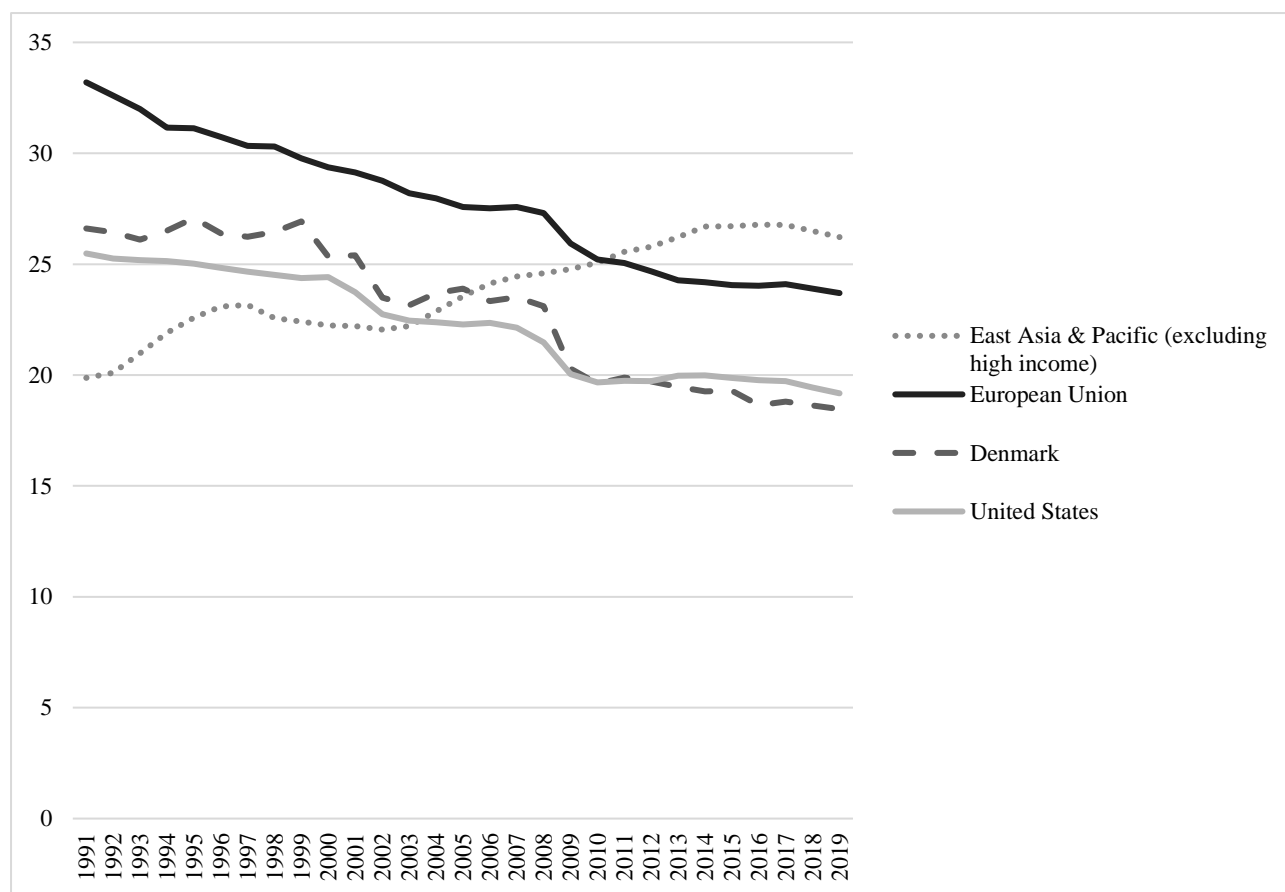


Figure 5.1: Development in industry employment across regions (% of total employment)

Source: The World Bank Databank. The industry sector consists of mining and quarrying, manufacturing, construction, and public utilities (electricity, gas, and water).

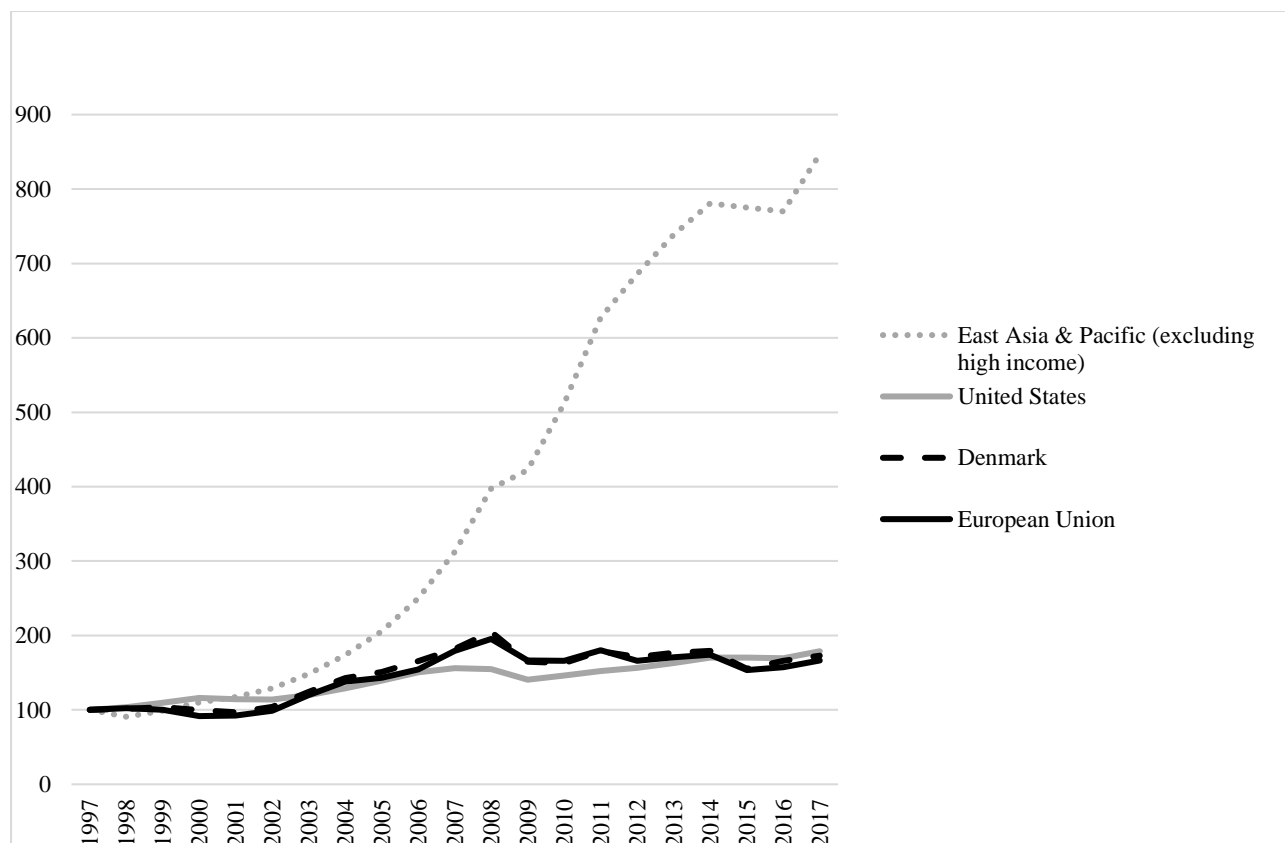


Figure 5.2: Development in value added across regions (current US\$, index 1997=100)

Source: The World Bank Databank. The industry sector consists of mining and quarrying, manufacturing, construction, and public utilities (electricity, gas, and water)

The concerns about survival of suppliers in high-cost countries has spurred a large number of studies that either argue for suppliers' need to relocate or focus on how to improve the framework conditions for supplier firms through industrial policy (e.g. Molnar et al. 2007). However, a relocation of suppliers to low-cost countries in order to improve their competitiveness might have adverse effects on the national competitiveness of the high-cost countries in general. Traditional perspectives on the drivers of national competitiveness often take an atomistic perspective on competitiveness and tend to overlook the innovation dynamics on a system level, as they are described in the innovation system literature and other literatures on system level innovation dynamics (Porter 1990; Lundvall 1992; Nelson 1993). According to this approach, cooperation and learning benefits accrued through interaction in user-producer relationships is at the heart of an innovation system's international competitiveness (Lundvall 1985; Christensen et al. 2008). Suppliers' development of value-creation

activities to maintain customer relationships can be seen at the centre of this dynamic, which is also the focus in this chapter.

Taking a supplier's perspective, the main purpose of this chapter is to deepen our understanding of the value creation activities pursued by suppliers in Denmark in a context of increasing global competition and production relocation. The analysis explores the avenues that suppliers in Denmark have followed in order to continue to maintain and develop relationships with their most important customers.

The analysis is based on a survey of 980 supplier firms in Denmark carried out in 2014, combined with register data on firm characteristics.ⁱⁱⁱ The survey reveals that although manufacturing is shrinking in Denmark, the share of industrial firms that serve as suppliers has remained relatively stable since a similar survey was carried out in 1994. But the function that suppliers fulfil in relation to their most important customers has changed considerably. As mentioned above, suppliers in high-cost countries face challenges and, accordingly, suppliers in Denmark have been considered to be a relatively vulnerable group of firms. However, when analysing the suppliers further, the vulnerability appears to be exaggerated – at least for the suppliers that have survived the transition – as many suppliers have developed strong ties to their most important customers (Drejer et al. 2015). The present chapter presents a data-driven typology of supplier firms in Denmark based on their value creation activities towards main customers and discusses this in light of overall characteristics of how firms in the Danish innovation system typically interact. In this sense, we follow in the footsteps of a well-grounded innovation research tradition dating back to Pavitt (1984).

5.2 The Changing Role of Suppliers – A Review of the Literature

Since the 1990s, manufacturers in Denmark and other high-cost countries have increased their international sourcing activities and established supply chains in low-cost countries (Coucke and Sleuwagen 2008; Statistics Denmark 2008). This development has led to a debate with respect to the implications and future prospects for the manufacturing suppliers in high-cost countries (Scott and Storper 2003). Already in the 1980s and 1990s, there was a growing concern about the competitive decline of firms in high-cost economies due to loss of internal capabilities (Bettis, Bradley and Hamel

1992). In its turn, both offshoring decisions of customers and the competitive threat from low-cost country suppliers affect domestic suppliers' ability to maintain customer relationships. High-cost country suppliers have experienced that customers strip out standardized components from the most sophisticated activities and in essence move manufacturing activities to low-cost country suppliers (Mudambi and Venzin 2010). Increasing internationalization may change the internal cohesiveness of a National Innovation System. From a National Innovation System perspective, the interaction and corresponding flow of activities between the system elements is a core element for explaining the system's ability to create and maintain innovations (Edquist and Hommen 2008). Notably user-producer interaction is a central element for generating novelty and innovation, because they can communicate information about technological opportunities as well as user needs and in some instances also involve joint problem-solving activities (Lundvall 2016, 122). As also discussed by Kringelum et al. (this volume), trust and commitment increases the mutual benefits and general effectiveness of user-producer interactions, which implies that not all relations between suppliers and their users/customers can be prioritized equally, and there may be a tendency to value local relations. It is, however, not a new observation that National Innovation Systems have become 'leakier', and that internationally oriented firms act as vehicles for internationalization of innovation systems (Carlsson 2006). But the emphasis in the National Innovation Systems literature has been on the *national* elements, and there has been less focus on the international influences on the systems, including on understanding how the accelerating globalization of value chains and possible erosion of conventional proximity advantages impacts the positioning of suppliers in high-cost country systems. Suppliers from high-cost countries that seek to create value propositions that are attractive to customers in a globally competitive market face the immediate challenge of matching direct cost differentials offered by low-cost country suppliers, but also face challenges with respect to bandwagon effects, as there seems to be a strong consensus among manufacturers about the benefits of sourcing from low-cost countries (Kotabe and Mol 2006). Low-cost country suppliers are increasingly well placed to compete in producing more high value-added types of production. This has been in response to rising wages in several manufacturing sectors (Lee and Ki 2017; Safdar and Gevelt 2019).

However, the value propositions of low-cost country suppliers are not necessarily superior (Horn, Schiele and Werner 2013). They may be matched and challenged by high-cost country suppliers.

High-cost country suppliers' ability to initiate, maintain and develop value propositions that differentiate them from their rivals is central to their value chain position. For a supplier, creating a value proposition in a customer relationship comes with choice, since no firms are equally good at providing all forms of value propositions. A supplier must configure a set of activities that is considered valuable by customers while also being resource coherent and profitable for the supplier.

Our focus in this contribution is on identifying profiles of the supplier firms in Denmark, which managed the transition to expand their value proposition towards customers and survive despite the increasing competition from suppliers in low-cost countries. The following sections unfold that data and methods applied in the analysis.

5.3 Data

The analysis is based on a unique cross-industry data set on suppliers' relations to their most important customers. This data set is based on a non-mandatory survey carried out in 2014 of the total population of 4196 firms in Denmark with at least 10 employees (excluding micro firms) in manufacturing industries, as well as a few selected business services industries (see Table 5.1). The survey takes a supplier perspective focusing on the relations and deliveries to the most important customer. The suppliers' deliveries to their most important customers can comprise physical products, components and different types of services.

CEOs and CTOs from 980 firms answered the questionnaire, resulting in a response rate of 23.4 percent. The survey, which was carried out by Statistics Denmark on behalf of Aalborg University, covered issues such as the location of the customers, the duration of the relation between the supplier and customer, the customers' economic importance, suppliers' involvement in customers' development projects, type and content of main deliveries, the supplier firms' competencies and statements on the extent of various types of interactions, and relations to most important customers.

The survey data are matched with register data from Statistics Denmark on firm size, industry affiliation, employee background and economic performance.

Table 5.1: Included industries

	No. and percentage of firms in population		No. and percentage of firms in respondent group	
Mfr. of food products, beverages and tobacco products	390	9,3%	66	6,7%
Mfr. of textiles, wearing apparel, leather and leather products	79	1,9%	20	2,0%
Mfr. of wood and products of wood and cork, except furniture	104	2,5%	25	2,6%
Mfr. of paper and paper products	60	1,4%	17	1,7%
Printing or reproduction of recorded media	118	2,8%	20	2,0%
Mfr. of coke and refined petroleum products, chemicals and chemical products, basic pharmaceutical products and pharmaceutical preparations	95	2,3%	24	2,4%
Mfr. of rubber and plastic products	188	4,5%	57	5,8%
Mfr. of other non-metallic mineral products	122	2,9%	25	2,6%
Mfr. of basic metals, fabricated metal products, except machinery and equipment	665	15,8%	179	18,3%
Mfr. of computer, electronic and optical products	161	3,8%	42	4,3%
Mfr. of electrical equipment	115	2,7%	32	3,3%
Mfr. of machinery and equipment n.e.c.	511	12,2%	112	11,4%
Mfr. of motor vehicles, trailers and semi-trailers, and other transport equipment	86	2,0%	15	1,5%
Mfr. of furniture	142	3,4%	28	2,9%
Other manufacturing	81	1,9%	24	2,4%
Repair and installation of machinery and equipment	152	3,6%	29	3,0%
Computer programming, consultancy and related activities	606	14,4%	122	12,4%
Architectural and engineering activities; technical testing and analysis	381	9,1%	106	10,8%
Scientific research and development	87	2,1%	24	2,4%
Specialized design activities	53	1,3%	13	1,3%
<i>Total</i>	<i>4196</i>	<i>100,0%</i>	<i>980</i>	<i>100,0%</i>

The survey is inspired by a similar survey carried out in Denmark in 1994, thereby allowing an identification of possible changes in general patterns of suppliers' relations to their most important customers between 1994 and 2014.

A comparison of the two surveys (see Table 5.2) shows that suppliers continue to have an important role in the manufacturing sector of Denmark. However, important changes can be found with respect

to both the length and the scope of suppliers' collaboration with their most important customers (Drejer et al. 2015).

Table 5.2: Comparing findings from two surveys on Danish suppliers' collaboration with their most important customers

Supplier survey 1994*		Supplier survey 2014**	
Customers provide components or raw materials to be processed by supplier	18%	Suppliers process materials supplied by customers	25%
Customers frequently exchange new product ideas with suppliers	42%		
Joint R&D activities between customers and suppliers	22%		
Supplier involved in customers' product development	43%	Customer and supplier collaborate on the development of products and services	81%
Customers involved in supplier's product development	29%		
Products are typically developed based on the customers' technical specifications	45%	Products are developed based on technical specifications	78%
		Products are developed based on customers' specifications	84%
Supply governed by contractual arrangements with customers	34%	Supply governed by long-term contractual arrangements with customers	67%

* The percentage of firms, which answered that the specific type of relation existed vis-à-vis the most important customers.

** The percentage of firms, which answered that the specific type of relation existed to some or a high degree vis-à-vis the most important customers.

We have taken a cautious approach in comparing the findings from 1994 and 2014 surveys, by only counting the suppliers who responded that a specific type of relation existed to some or to a high extent. Also including suppliers in the 2014 survey who acknowledged that these types of relations existed to 'a minor extent' would have shown an even more dramatic change. Although the comparisons in Table 5.2 are coarse, they portray a significant change suggesting that relationships between suppliers in Denmark and their most important customers have become closer than arm's length in orientation. It tells a story of a dramatic increase in the scope of buyer-supplier exchange relationships, including both development and production activities. Furthermore, the proportion of contractually governed customer relationships have doubled. This suggests long-term relationship governance rather than adverse competitive regimes in supply chains (Wathne and Heide 2004). It implies that suppliers configure customer relationships in order to maintain strategic positions vis-à-

vis their customers. Furthermore, it has become the rule rather than the exception that suppliers participate actively in their customers' product and service development activities, testifying a move from arm's length exchange towards more engaged forms of collaboration with customers.

These observations imply that contemporary suppliers in Denmark – taking a more passive role in the past – now actively configure customer relationships in order to maintain strategic positions vis-à-vis their customers, while at the same time being pressured on delivering both cost and value optimization by their customers. This observation from Denmark is in accordance with findings by Lindgreen et al. (2013), seen from the purchasing perspective of US companies. Furthermore, although the applied data do now provide information on work organisation, the findings of the recent survey are in accordance with other innovation system-related studies that include firm-level data for Denmark, such as Lorenz (2015) and the chapter by Holm and Lorenz (this volume), who find that Denmark together with other Nordic countries has the highest proportion of employees working in industry or service sector firms characterised by a form of work organisations assumed to promote interfirm cooperation.

5.4 Method

In order to identify the different value creation activities that Danish firms pursue in their customer relations, principal factor and cluster analyses are performed on the supplier firms' responses to 24 statements regarding their relations with their most important customers (see Table 5.3). Due to item non-responses, the cluster analyses are carried out on responses from 663 supplier firms.^{iv} The suppliers are asked to indicate the degree to which they engaged with their key customers in each of the 24 activities expressed in the statements. The engagement is measured on a 4-point scale, ranging from 'to a large extent' to 'not at all'. Respondents can also reply 'do not know', but such answers are treated as non-responses in the analyses. Because several of the 24 variables based on the statements are highly correlated, the analyses are carried out in two steps. First, a principal factor analysis is carried out based on the polychoric correlation between the 24 variables. Five factors are retained in the principal factor analysis.^v The factor loadings of the variables associated with the 24 statements are illustrated in Table 5.3.

Factor 1 relates to *Inter-Organizational integration* in terms of the degree to which organizational structures and processes are aligned across the organizational interface. Differences in the extent to which employees are exchanged, joint collaboration on new products, the establishment of cross-organizational teams, joint training etc. all contribute to this notion.

Factor 2 reflects *Openness* in terms of information-sharing activities in the buyer-supplier relationships and indications of the willingness to share information across the organizational interface in terms of, among other things: joint purchasing arrangements, cost reduction sharing and open calculations.

Factor 3 reflects *Commitment* as expressed by customer-specific investments and other obligations taken on by the supplier in the buyer-supplier relationship, such as product responsibilities.

Factor 4 concerns the *Formalization* of exchange in terms of the extent to which procedures guide interactions. Here, formalization covers the role of specifications and agreeing to terms of an order.

Finally, factor 5 concerns suppliers' *Standardization* of products and services in customer relationships. This factor covers items such as supplier specification or adaptation of standard products and services.

Table 5.3: Principal factor analysis - Rotated Factor Pattern

		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	Collaborates on the development of new products/services	0.40195	0.10809	0.29930	0.23852	0.21913
2	Exchanges/posts of employees	0.59010	0.16188	-0.17450	0.23839	0.02513
3	Establishes cross-organizational teams	0.77765	0.11002	0.07531	0.10765	0.02346
4	Carries out joint training/education	0.63368	0.04507	-0.01724	-0.04707	0.16208
5	Cooperates on the optimizing of processes	0.52208	0.20726	0.13672	0.31664	0.01030
6	Supplies products/services produced according to technical specifications	0.15046	0.22709	0.44057	0.47822	-0.01586
7	Guarantees certification or other types of documentation or approval	0.04761	0.14389	0.57978	0.13918	0.10169
8	Functions as an extra production capacity	0.13734	0.63236	-0.02049	0.15880	-0.00694
9	Makes adaptations to materials/intermediate goods supplied by the customer	-0.02600	0.68575	0.04275	0.24714	-0.03178
10	Supplies products/services, that are sold under the trademark of the customer	-0.05176	0.55344	0.30389	-0.13566	0.06598
11	Uses open calculations	0.35499	0.51326	0.08424	0.04946	-0.12036
12	Engages in joint co-operation with approved technical service institutions or universities	0.49753	0.14521	0.23207	-0.08314	0.03629
13	Agrees on prices and conditions of delivery per order	0.05303	-0.00446	-0.04847	0.52347	0.04513
14	Shares the achieved cost reductions	0.23724	0.47070	0.40275	-0.02286	-0.09631
15	Enters into long-term contracts	0.38405	0.03667	0.36138	-0.05038	0.02546
16	Integrates technology from other suppliers to the customer	0.54633	0.07877	0.23290	0.34096	0.08172
17	Provides advice on customers' technologies or materials	0.45336	0.04628	0.26073	0.41897	0.06933
18	Engages in joint purchasing	0.35843	0.57368	0.19053	-0.03621	0.03583
19	Invests in customer-specific technology, machinery or equipment	0.24634	0.38684	0.41984	0.05778	0.06799
20	Supplies products/services according to the customers' specifications	0.03559	0.37940	0.32277	0.57020	0.10600
21	Specifies products/services for the customers	0.26968	-0.02980	0.20027	0.43190	0.47335
22	Adapts standard products/services to the requirements of the customers	0.17637	0.06133	0.13947	0.23698	0.74814
23	Supplies standard products/services to the customers	0.00498	-0.12736	-0.01377	-0.12488	0.70357
24	Takes on product responsibility for components or systems that are integrated in the products/services of the customer	0.04028	0.10515	0.42016	0.15291	0.36277
	<i>Variance explained by each factor</i>	<i>3.2158</i>	<i>2.5141</i>	<i>1.8009</i>	<i>1.7702</i>	<i>1.5584</i>

In the second step of the analysis, the factor loadings are used as input to a k-means cluster analysis, where a solution with three clusters is chosen as the most stable (Table 5.4). The identified clusters of firms are interpreted as expressions of different value creation activities pursued by suppliers with regards to relations to their most important customers.

Each supplier firm is exclusively associated with one cluster. However, the negative value of the Cubic Clustering Criterion statistic^{vi} (-3.382), which is a measure of within-cluster homogeneity relative to between-cluster heterogeneity (Ketchen and Shook 1996), indicates a large heterogeneity in the data with possible outliers. The clusters should thus not be perceived as very stable types of supplier firms, but rather as a grouping of the main types of supplier behaviours towards their most important customers.

Table 5.4: K-means clustering – cluster means

Cluster	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	-.2072	-.3915	-.6408	-.8131	-.0585
2	0.5290	0.9689	0.1490	-.0651	0.1915
3	-.1630	-.2695	0.2598	0.4431	-.1694

The first cluster consists of firms that are characterized by engaging very little with their customers, reflected in the negative means value on all five factors for this cluster. Accordingly, this cluster is labelled *Detached Suppliers*. The second cluster consists of firms with high means for factors 1, 2 and 5, reflecting suppliers with a wide scope of engagement with customers. These can be labelled as *Integrated Suppliers*. The third cluster consists of firms with high means for factors 3 and 4, reflecting suppliers with a strong emphasis on technical and technology-related aspects in their engagements with customers. This cluster can be labelled *Technology-focused Suppliers*.

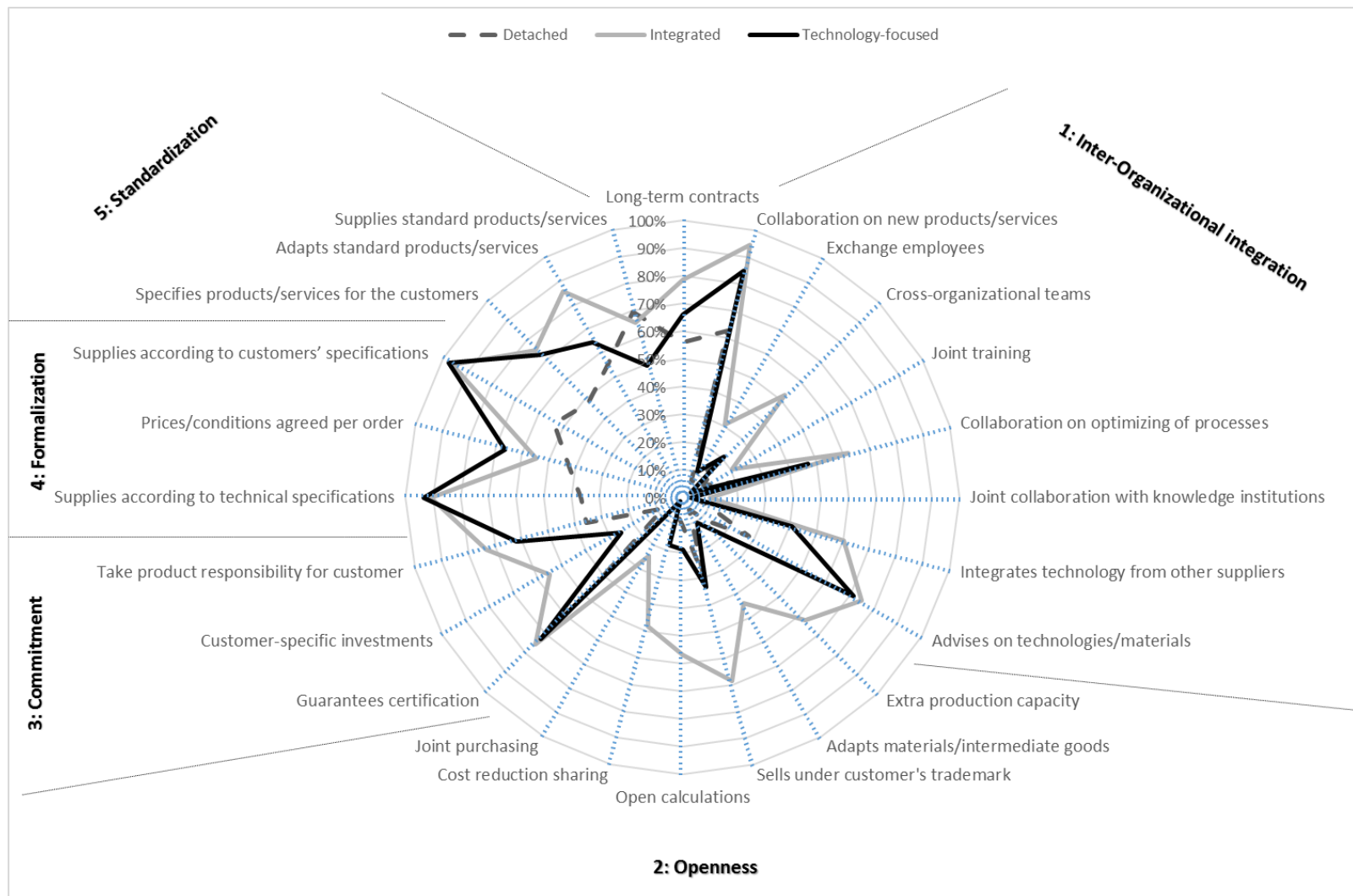


Figure 5.3: Visual overview of value creation activities pursued by the three types of suppliers

Figure 5.3 provides a visualization of the three identified types of value creation activities in terms of the extent to which each supplier type takes on each of the 24 different activities in the buyer-supplier relationships. The 24 activities are grouped into the five factors identified in the principal factor analysis based on the correlation between the variables explaining each factor.

It is apparent from Figure 5.3 that there are many similarities between the *Integrated* and the *Technology-focused* supplier types. Both types of suppliers engage closely with customers. However, there is a decisive difference in the scope of activities provided. The *Integrated* suppliers generally seek to align as many types of activities as possible. *Technology-focused* suppliers, on the other hand, adapt fewer types of activities to their customers. The activities that *Technology-focused* suppliers adopt are mainly linked to the provision of technology inputs to their customers. The limited area outlined for the *Detached* suppliers in Figure 5.3 illustrates that this type of suppliers mainly provides standard offerings and in general is involved in few different types of activities with their customers. The following sections provides more detailed characteristics of the three identified supplier types.

5.5 Supplier Types in Denmark: Characterising the Different Approaches

Followed by Suppliers

Combining the survey data with register data on industry affiliation, financial accounts, and employee information allows for a comparison of characteristics between the firms in the three identified types of supplier firms. Table 5.5 shows the industry and size distribution of firms across the three types of suppliers firms, share of firms that import and export, as well as the location of the most important customer, while Table 5.6 provides a more detailed characteristic of the firms assigned to each type. Table 5.7 presents the results of a multiple logistic regression model of suppliers' types, which allows for a detailed comparison of firms' likelihood of being classified as an Integrated supplier or Technology-focused supplier relative to being a Detached supplier. The data presented in the three tables is discussed in detail during the description of the three types below.

Table 5.5: Industry and size distribution of the different supplier types, as well as location of the most important customer

		Detached	Integrated	Technology-focused
Share of analysed firms		19%	35%	46%
High tech manufacturing		4%	7%	3%
Medium-high tech manufacturing		16%	23%	21%
Medium-low tech manufacturing		14%	30%	24%
Low tech manufacturing		36%	21%	23%
Services		35%	20%	29%
Less than 20 employees		36%	28%	38%
20-49 employees		44%	38%	38%
50-99 employees		12%	17%	14%
100 + employees		8%	18%	10%
Export		71%	83%	67%
Import		71%	79%	74%
Location of the most important customer	Denmark	74%	67%	71%
	Germany	5%	7%	5%
	Sweden	5%	5%	3%
	USA	5%	3%	3%
	Norway	3%	3%	3%
N (weighted)		130	237	315

Note: Weighted according to the size and industry distribution of the population

Source: Own calculations based on survey and register data.

Table 5.6: Characteristics of the different supplier types

	Detached		Integrated		Technology-focused	
	Mean	Median	Mean	Median	Mean	Median
Employees (FTE)	49	22	100	33	51	22
Share of highly educated employees	0.12	0.04	0.09	0.03	0.11	0.04
Most important customer's share of turnover	22	15	31	25	23	17
Duration of relationship with most important customer (years)	16	12	15	14	16	14
Growth in FTE 2012-15	0.07	0.10	0.06	0.04	0.004	0.05
Value added per FTE 2015	654212	575713	690048	621337	697416	646536
Growth in value added per FTE 2012-15	0.11	0.07	0.04	0.06	0.15	0.08
N (weighted)		118		231		297

Note: Outliers are removed in the calculations of growth rates. The average growth in FTE in 2012-15 is calculated by the following formula in order to avoid problems of high growth in very small firms distorting the results: $(\text{FTE 2015} - \text{FTE 2012}) / (\text{FTE 2015} + \text{FTE 2012}/2)$. A similar method is used for value added growth measures.

Source: Own calculations based on survey and register data.

Table 5.7: Multiple logistic regression model of suppliers' types

	Benchmark: Detached	Integrated			Technology-focused		
Parameter		Estimate	Standard error	Pr > ChiSq	Estimate	Standard error	Pr > ChiSq
Intercept		-2.089	0.610	0.001	-0.389	0.559	0.486
Employees, FTE (log)		0.422	0.138	0.002	0.147	0.135	0.279
Share of highly educated employees		0.096	1.044	0.927	0.923	0.908	0.309
Most important customer's share of turnover		0.026	0.006	0.000	0.003	0.006	0.657
Duration of relationship with most important customer (years)		-0.018	0.010	0.070	-0.000	0.009	0.973
Value added per FTE 2015		0.000	0.000	0.678	0.000	0.000	0.173
Export (yes/no)		0.565	0.329	0.085	-0.406	0.285	0.154
import (yes/no)		-0.068	0.330	0.838	0.323	0.298	0.278
Industry: benchmark services	Low tech manufacturing	-0.108	0.420	0.797	0.038	0.374	0.919
	Medium-low tech manufacturing	1.185	0.455	0.009	0.972	0.422	0.021
	Medium-high tech manufacturing	0.553	0.458	0.227	0.613	0.421	0.145
	High tech manufacturing	0.873	0.600	0.146	-0.543	0.664	0.413
N (weighted)	641						
R ²	0.14						

5.5.1 Detached Suppliers

The Detached suppliers account for the smallest share of analysed firms (19%). Of those, 36% have less than 20 employees and 80% have less than 50 employees. Moreover, 35% of the firms are in services, which in the current analysis includes five service-subsectors assumed to be closely related to manufacturing (see Table 5.1), and 36% are low-tech manufacturing firms. Responses show that 87% of the Detached suppliers report that their most important customer is located in Denmark or one of the three neighbouring countries, Sweden, Norway and Germany.

Table 5.6 reveals that the Detached suppliers' mean number of 49 employees is substantially lower than the Integrated suppliers.

The Detached suppliers are characterized by supplying standard products or services to their main customers, including customized standard products or services. They also frequently supply products or services that are specified by their customers. The detached suppliers also often enter long-term contracts with their customers, but as Table 5.6 shows, the mean duration of the most important customer is 16 years, which is only slightly higher than the integrated suppliers. The detached suppliers are characterized by a much more limited extent of interactions with their main customers than the other two supplier types. Figure 5.3 shows that, typically, the Detached suppliers do not collaborate with their main customers on organizational and employee-related areas such as exchange of employees or using cross-organizational teams. In general, they score low on the factors reflecting inter-organisation integration and openness. This could potentially limit their importance for user-producer type of innovation collaboration with their main customers. However, most of the Detached suppliers also collaborate with their main customers on the development of new products and services. This might seem at odds with the low extent of interaction with their customers compared to the other supplier types, but the Detached suppliers have the highest share of highly educated employees (12%). Thus, it seems that the Detached suppliers rely on a relatively highly skilled workforce and automation.

The Detached suppliers appear to be very different from the standard suppliers with an arms-length relationship that was the dominating supplier type in Denmark in the early 1990s (Andersen and Christensen 1998). The Detached supplier type has a higher level and extent of interaction with their most important customer – which may explain why the Detached suppliers is no less inclined than the Integrated and Technology-focused suppliers to identify customers located in relative geographical proximity as the most important ones^{vii} – and also has an highly-educated workforce. Furthermore, they are not in any apparent financial distress or decline: The Detached suppliers have had the highest growth in FTE during 2012-15 and also a high growth in value-added per FTE. They do, however, still have a slightly lower than average level of value added per FTE in 2015 compared to the other two supplier types.

5.5.2 Technology-focused Suppliers

Technology-focused suppliers comprise the largest group of firms in the sample (46%). Table 5.7 reveals that they are more likely to be found in medium-low tech manufacturing compared to the Detached suppliers. The average firm size is 51 employees, which is less than the Integrated suppliers, and approximately the same average size as the Detached suppliers. Responses show that 82% of the Technology-focused suppliers identify Denmark, Norway, Sweden or Germany as the location of their most important customer.

The Technology-focused suppliers have the highest average value-added per FTE of the three supplier types and also the highest growth in value added per FTE during 2012-15. The median growth rate of FTE during 2012-15 is 5%, but the average growth is barely positive, since some firms have declined. The Technology-focused suppliers are in general characterized by a broader extent of interaction with their main customers compared to the Detached suppliers, but less than the Integrated suppliers. Most of Technology-focused suppliers are collaborating with their main customers on the development of new products or services. They provide their customers advice on materials, and guarantee certification or provide other types of documentation of products or services. They also score high on the formalization factor by supplying according to customers' specifications or technical specifications. The majority of the Technology-focused suppliers take on product responsibility for components or systems that are integrated into the customers' products or services. They have a higher share of highly educated employees (11%) than the Integrated suppliers. The characteristics of the technology-focused suppliers to some extent fit with the profile of the development orientated type of suppliers that accounted for 34% of the firms in Denmark in 1994 (Andersen and Christensen 1998). However, in addition to participating in the customers' development activities and entering long-term contracts with the main customer, the development-oriented suppliers also invested in customer-specific specific technology and machinery. Only a minority of the Technology-focused suppliers do that.

5.5.3 Integrated Suppliers

The Integrated suppliers account for 35% of the analysed firms. The Integrated supplier firms are more likely to be found in medium-low tech manufacturing compared to the Detached supplier type. On average, the firms employ 100 people, and the average share of highly educated employees is 9%. The most important customers' share of turnover accounts for 31% on average, which is higher than for the other supplier types. The main characteristic of the Integrated suppliers is the broad scope of collaboration with their main customers. They score high on the factors related to inter-organisational integration and openness. Nearly all collaborate with their main customers on the development of new products or and establish cross-organizational teams with their main customers. They also collaborate with the main customers on process optimization and advices on technology as well as integrates technology from other suppliers. They also score high on commitment in terms of taking product responsibility and invest in customer-specific technology, machinery or equipment. In contrast, they also adapt standard products and services to the requirements of the customer, as well as supplies standard products and services and act as extra production capacity for the customers.

The Integrated suppliers are characterized by a broad scope and a high degree of customer-specificity in their value creation activities. One the one hand, they are very active in knowledge sharing activities and contribute to the main customers' innovation activities, but on the other hand, they are also involved in a range of activities related to standardization and formalization. Thus they offer a broad spectrum of activities. This capacity to engage widely with customers is probably related to the Integrated suppliers' larger average size. It is worth noticing, that despite the close integration with the most important customers, the Integrated suppliers have the lowest share of firms (although 82% is still a high proportion) reporting that the most important customer is located in Denmark or in one of the three neighbouring countries.

5.6 Concluding Discussion

This chapter has described three contemporary – and by all accounts also viable – strategies for interaction with and activities provided for important customers, followed by Danish supplier firms.

The Danish Innovation System has for decades been characterised as interaction-oriented (e.g. Christensen et al. 2008). Nonetheless, the analyses presented in this chapter, when compared to similar analyses based on data from the 1990's, indicate that interfirm interactions – at least when looking at customer-supplier interactions – has evolved further, to the extent that strong ties between suppliers and their most important customers are now characteristic of the two most dominant types of supplier firms' value-creating activities towards their main customers. And even the most detached type of supplier strategy involves selected elements of close interaction. The Danish Innovation System has become more international with distributed innovation activities, relocation of production, increasing participation in global value chains, and exports/imports. However, the suppliers participate in a larger extent in user-producer interaction activities. The national innovation system literature tends to focus on national interactions and knowledge flows, which is also important for the Danish suppliers as between two-thirds and three-quarters of the suppliers have their most important customer in Denmark. However, the integrated suppliers who have the greatest scope of interaction with their customers, are the type of supplier that are most likely to export and have their most important customers outside Denmark more frequently than the other types.

We have analysed this transition in supplier activities towards the most important customers in the wake of the increasing internationalization and global relocation of manufacturing activities, which is facilitated by digitalization-supported coordination opportunities. This could have been detrimental to the 'Danish way' of interfirm interaction and, accordingly, altered the structure of the Danish Innovation System. However, this does not seem to have been the case, even when it comes to the types of firms that have been assumed to be most vulnerable in the global competitive game, namely the typical relatively small suppliers to the manufacturing sector, who are facing strong price competition from suppliers in low-cost countries. The proportion of manufacturing jobs has declined in Denmark, just as is the case in other high-cost countries. And some Danish supplier firms have without doubt been outperformed by international competitors. One of the limitations of the this chapter's analysis is that we are not able to systematically follow which supplier firms have gone out of business over the last couple of decades and which firms have been able to transform and adjust to

the changing conditions. But the Danish supplier firms have not been wiped out, nor are there any indications of them having entered into a race to the bottom competition with suppliers in low-cost countries. On the contrary, it seems as if the surviving supplier firms have extended their collaborative activities with their main customers with point of departure in what has been considered one the traditional strengths of the Danish Innovation System, and thereby been able to continue the further development of this particular trait of the system. One aspect that has been discussed in relation to this is the link between the doing using and interacting (the STI and DUI mode) in innovation systems and innovation and learning in buyer-supplier relationships (Jensen et al. 2007). A possible mechanism for explaining the persistence of Danish suppliers' relationships to key customers in spite of global competitive pressure from low-cost countries can be proposed in the linkage between the changing scope of collaboration and its ability to support a more varied and broader spectrum of innovation and learning forms. A further exploration of this question is a task for future research.

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ⁱ This chapter draws on similar survey data and typologies as Andersen et al. (2019). The data collection was funded by the Danish Industry Foundation.

ⁱⁱ Calculations are based on estimated data from the World Bank Database and the International Labour Organisation's ILOSTAT database. Over the period 1997 to 2006, the increase in the East Asia & Pacific (excluding high income) Region has exceeded the increase in the European Union, Denmark and the United States by a factor of at least 2.5. This indicates that even if increased automation can explain some of the declining employment in industry in high-cost countries, this is more than out-weighted by the catching up of countries in the East Asia & Pacific region.

ⁱⁱⁱ Because of incomplete responses to the survey, as well as missing data for some firms in the register data, our analyses are generally based on less than 980 observations.

^{iv} With the exception of the proportion of suppliers that process materials supplied by customers, which is only 17% for the firms included in the principal factor and cluster analysis, compared to 25% for all respondents in the survey, these firms have a distribution similar to all respondents in terms of the aspects of collaboration with their most important customers, which are shown in Table 5.2.

^v In principal factor analysis, it is quite common with negative eigenvalues because the data do not fit the common factor model perfectly. This causes the cumulative proportion of variance explained to exceed 1 for several factors. According to the guidelines provided by SAS Institute Inc. (2013), the cumulative proportion of variance explained by the retained factors should in these cases be approximately 1 for principal factor analysis. This criterion has been applied in the decision to retain five factors.

^{vi} As a rule of thumb, a value of the Cubic Clustering Criterion statistic greater than 2 indicates "good" clusters; values between 0 and 2 indicate potential clusters that should be used with caution; and large negative values can indicate outliers in the data.

^{vii} The Detached suppliers are in fact the supplier type that most frequently identify Denmark, Sweden, Norway, or Germany, as the location of the most important customer.